SDM4 in R: Displaying and Describing Quantitative Data (Chapter 3)

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Introduction and background

This document is intended to help describe how to undertake analyses introduced as examples in the Fourth Edition of *Stats: Data and Models* (2014) by De Veaux, Velleman, and Bock. More information about the book can be found at http://wps.aw.com/aw_deveaux_stats_series. This file as well as the associated R Markdown reproducible analysis source file used to create it can be found at http://nhorton.people.amherst.edu/sdm4.

This work leverages initiatives undertaken by Project MOSAIC (http://www.mosaic-web.org), an NSF-funded effort to improve the teaching of statistics, calculus, science and computing in the undergraduate curriculum. In particular, we utilize the `mosaic` package, which was written to simplify the use of R for introductory statistics courses. A short summary of the R needed to teach introductory statistics can be found in the mosaic package vignettes (http://cran.r-project.org/web/packages/mosaic). A paper describing the mosaic approach was published in the *R Journal*: https://journal.r-project.org/archive/2017/RJ-2017-024.

Chapter 3: Displaying and describing quantitative data

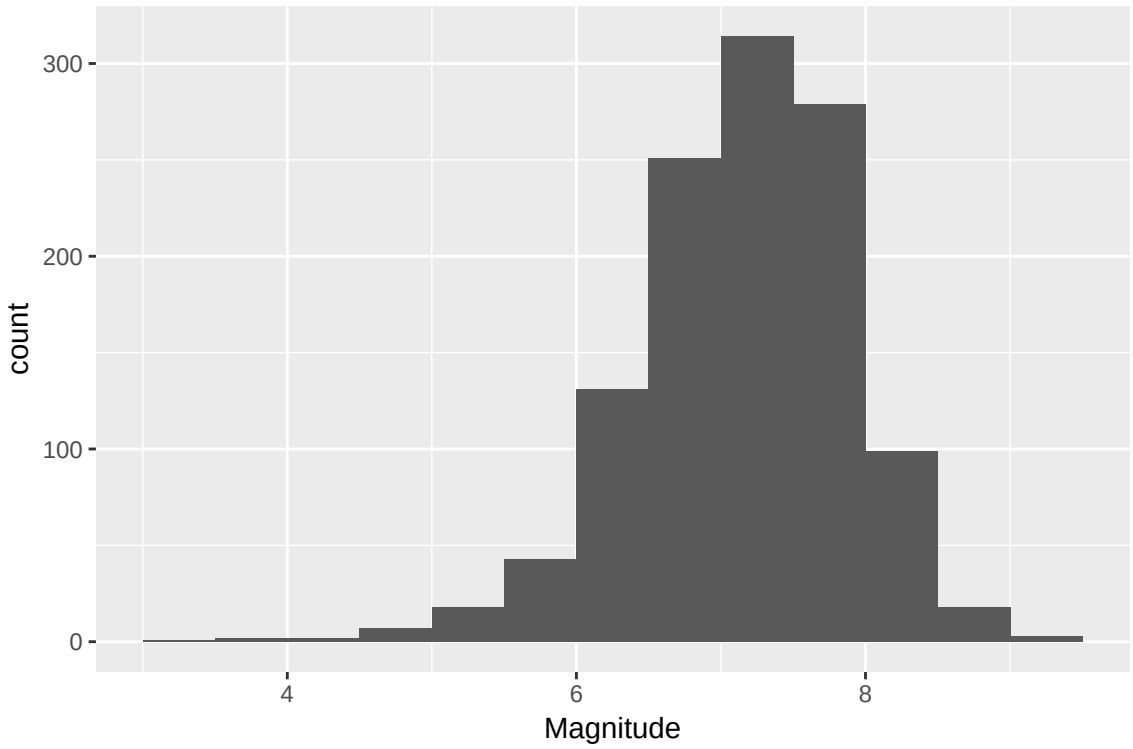
Section 3.1: Displaying quantitative variables

See Figure 3.1 on page 46.

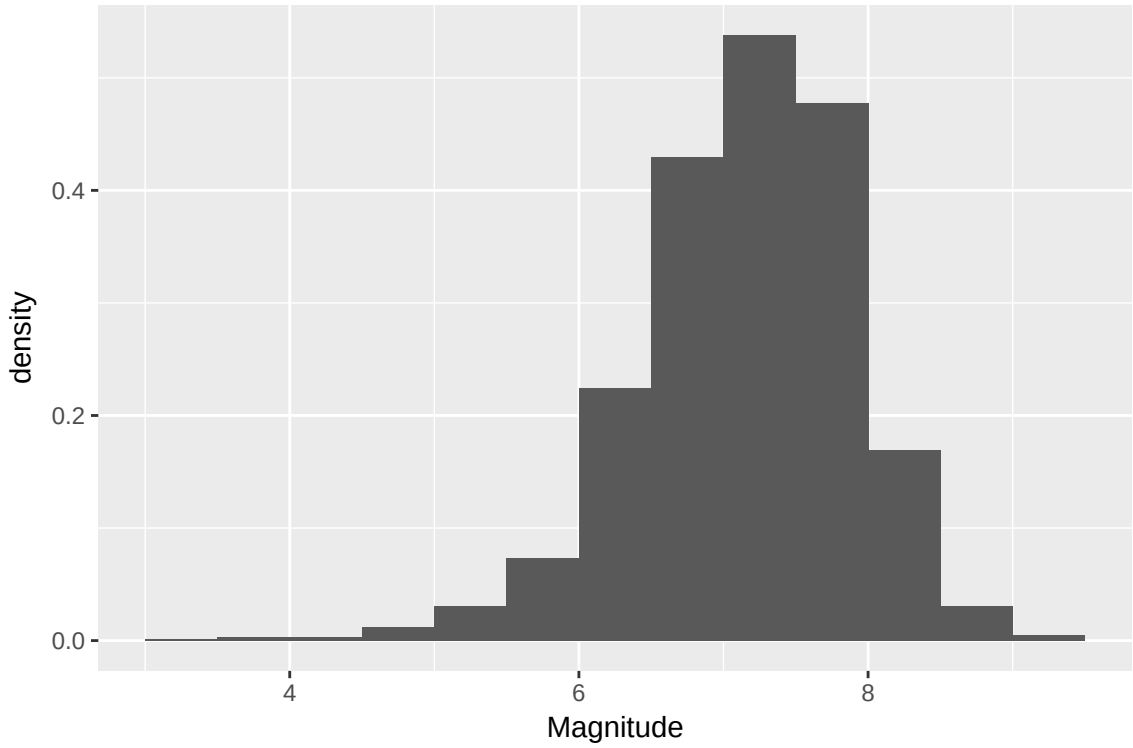
```
library(mosaic); library(readr)
options(digits=3)
Tsunami <- read_delim("http://nhorton.people.amherst.edu/sdm4/data/Tsunami_Earthquakes.txt",
  delim="\t")
nrow(Tsunami)
```

```
## [1] 1168
```

```
gf_histogram(~ Magnitude, binwidth=0.5, center=0.5/2+0.001,
  data=Tsunami)
```




```
gf_histogram(..density.. ~ Magnitude, binwidth=0.5, center=0.5/2+0.001,
  data=Tsunami)
```

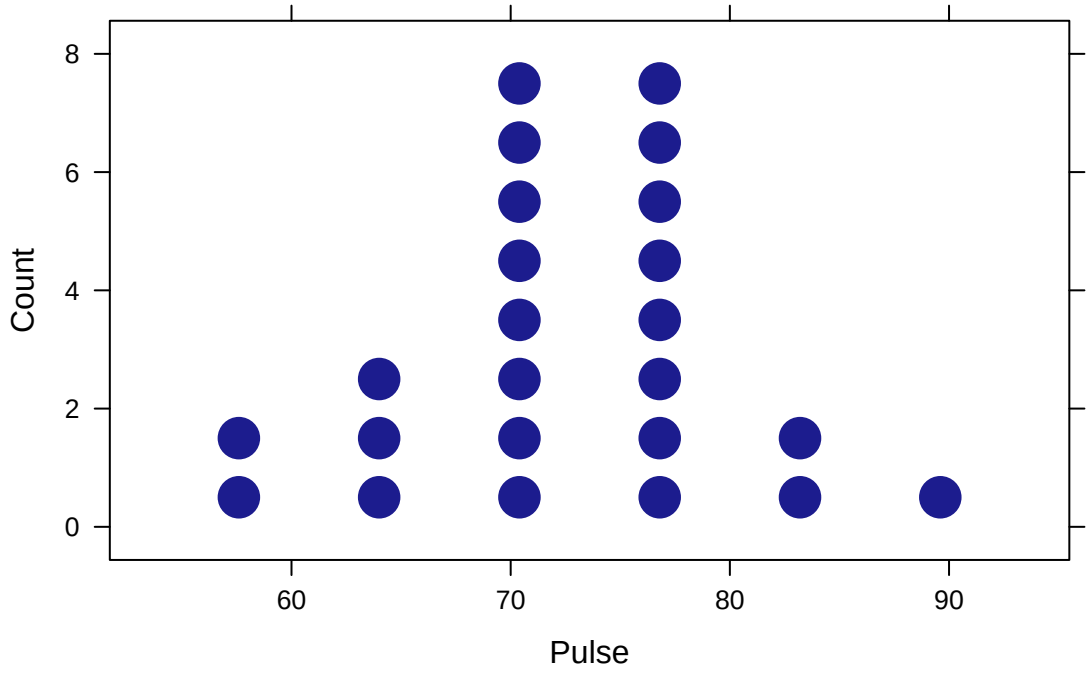


Note that Figure 3.3 on page 47 displays a histogram with the y-axis measured by percent in each bar. The first histogram displays the count and the last the density (where the total area of the bars adds up to 1).

```
Pulse_rates <- read_delim("http://nhorton.people.amherst.edu/sdm4/data/Pulse_rates.txt",
  delim="\t")
with(Pulse_rates, stem(Pulse))
```

```
##
##   The decimal point is 1 digit(s) to the right of the |
##
##   5 | 6
##   6 | 04448888
##   7 | 22226666
##   8 | 0000448
```

```
dotPlot(~ Pulse, data=Pulse_rates)
```



Or on page 49

```
with(Pulse_rates, stem(Pulse, scale=2))
```

```
##
##   The decimal point is 1 digit(s) to the right of the |
##
##   5 | 6
##   6 | 0444
##   6 | 8888
##   7 | 2222
##   7 | 6666
##   8 | 000044
##   8 | 8
```

Section 3.2: Shape

Section 3.3: Center

See calculation and Figure 3.11 on page 53.

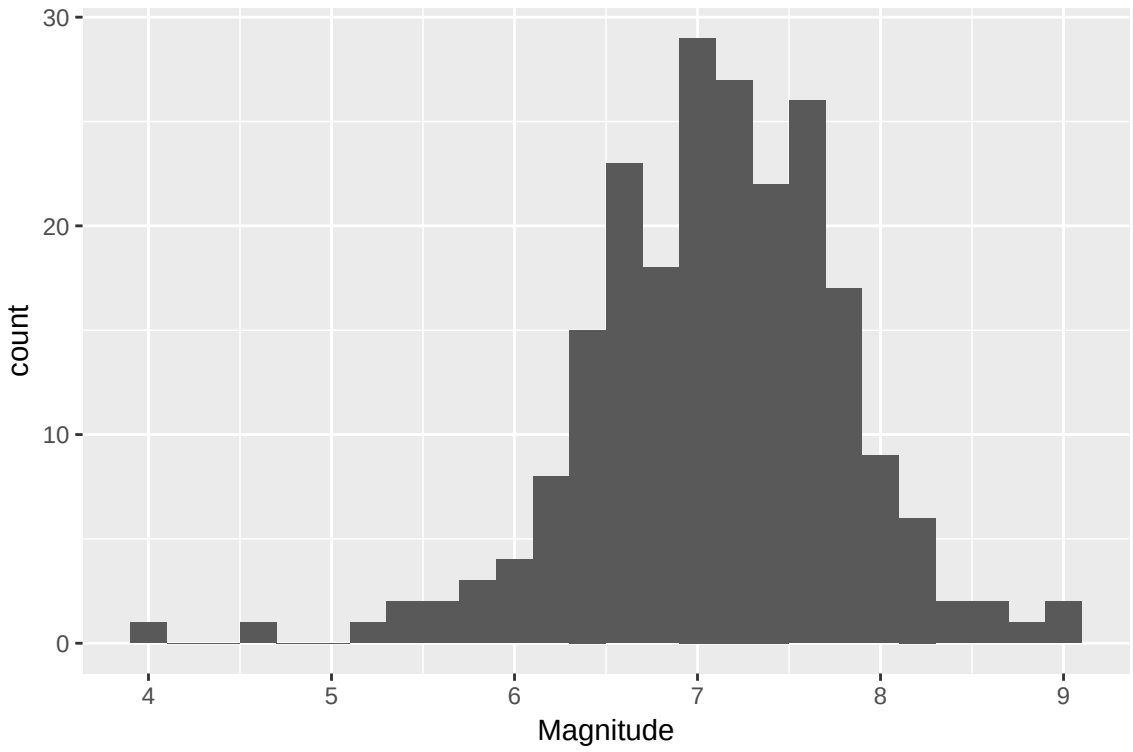
```
recent <- filter(Tsunami, Year >= 1989, Year <= 2013)
nrow(recent)
```

```
## [1] 221
```

```
median(~ Magnitude, data=recent)
```

```
## [1] 7.2
```

```
gf_histogram(~ Magnitude, binwidth=0.2, data=recent)
```



Section 3.4: Spread

See statistics reported on pages 54-55.

```
favstats(~ Magnitude, data=recent)
```

```
##  min  Q1 median  Q3 max mean    sd   n missing
##    4 6.7    7.2 7.6 9.1 7.15 0.702 221       0
```

```
range(~ Magnitude, data=recent)
```

```
## [1] 4.0 9.1
```

```
diff(range(~ Magnitude, data=recent))
```

```
## [1] 5.1
```

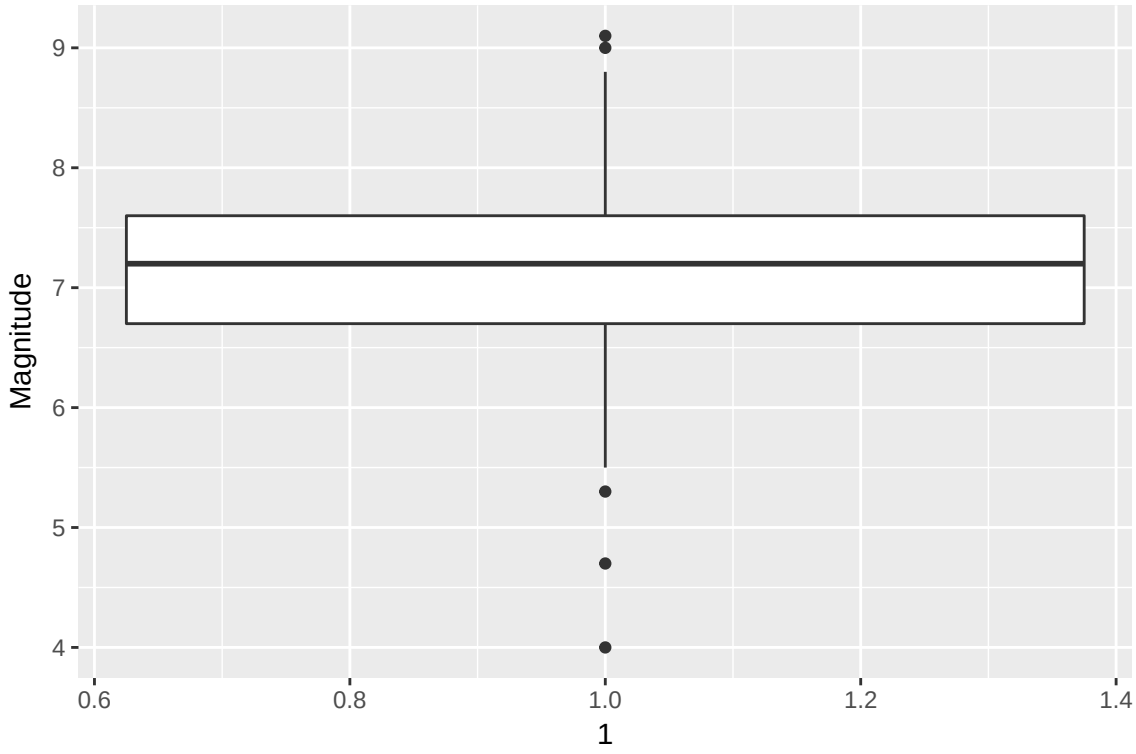
```
IQR(~ Magnitude, data=recent)
```

```
## [1] 0.9
```

Section 3.5: Boxplots and 5-Number Summaries

See display on page 57.

```
gf_boxplot(Magnitude ~ 1, data=recent)
```



Note that boxplots of a single distribution aren't usually very interesting (more useful displays will be seen in Chapter 4 when we start comparing groups).

Section 3.6: The Center of Symmetric Distributions: The Mean

See calculation on page 59.

```
mean(~ Magnitude, data=recent)
```

```
## [1] 7.15
```

```
median(~ Magnitude, data=recent)
```

```
## [1] 7.2
```

Section 3.7: The Spread of Symmetric Distributions: The Standard Deviation

```
sd(~ Magnitude, data=recent)
```

```
## [1] 0.702
```

```
var(~ Magnitude, data=recent)
```

```
## [1] 0.493
```

```
sqrt(var(~ Magnitude, data=recent))
```

```
## [1] 0.702
```

```
0.702^2
```

```
## [1] 0.493
```

The standard deviation squared equals the variance.